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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/801,804	03/09/2001	Hyung-Soo Song	8733.304.00	1434

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EXAMINER

LEE, HSIEN MING

ART UNIT

PAPER NUMBER

2823

DATE MAILED: 12/24/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/801,804

Applicant(s)

SONG ET AL.

Examiner

Hsien-Ming Lee

Art Unit

2823

— The MAILING DATE of this communication appears on the cover sheet with the correspondence address —
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 2 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 15 October 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 7-17 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 7-17 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 13) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.
- a) ☐ The translation of the foreign language provisional application has been received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s) _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Remarks

1. The objection to claim 7 and 112-second paragraph rejection to claim 7 are withdrawn.
2. Claims 7-17 are pending in the application.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 7, 9-11, 15 and 17 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Hwang et al. (US 5,851,303).

In re claims 7, 9, 15 and 17, Hwang et al. teach the claimed method of etching molybdenum on a silicon substrate, comprising:

- preparing an aqueous solution (i.e. an etching solution) comprising 1 to 10 % by weight of hydrogen peroxide (col 3, lines 21-24 and 36-41), balanced amount of water, which falls within the percentage range of about 99 to about 90 % because the solution is the aqueous solution, and an additive (i.e. nitric acid), which is a pH controlling agent (col. 5, lines 1-4), and
- applying the aqueous solution to etch the metal surface contaminant such as molybdenum on the silicon substrate (col. 4, lines 3-5 and 10-13), wherein the applying comprises immersing the silicon substrate into the aqueous solution.

Hwang et al. do not expressly teach that the additive (i.e. nitric acid) would activate an etching action of the hydrogen peroxide. However, claim 7 does **not** recite a **specific composition** as to the additive. It merely recites that the additive includes a pH-controlling agent (claim 17).

Since nitric acid in Hwang et al. is a pH controlling agent, one of the ordinary skilled in the art would have recognize that the nitric acid would act as an activating agent that activating the etching action of the hydrogen peroxide since **similar** process can reasonably be expected to yield product which inherently have the **same** properties. *In re Spada* 15 USPQ2d 1655 (CAFC 1990); *In re DeBlauwe* 222 USPQ 191; *In re Wiegand* 86 USPQ 155 (CCPA 1950).

In re claims 10 and 11, Hwang et al. also teach that the aqueous solution is applied to the silicon substrate at a temperature of between 20 °C to 30°C (col. 3, lines 57-63).

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 8 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hwang et al. (US '303) in view of McClean (US 4,462,861).

In re claim 8, Hwang et al. do not teach applying the aqueous solution (i.e. the etching solution) to etch the molybdenum on the silicon substrate by spraying the aqueous solution onto the silicon substrate.

However, etching the substrate by spraying the etching solution has been widely used in the art, as evidenced by McClean (col. 1, lines 59-66).

Therefore, it would have been obvious to one of the ordinary skill in the art, at the time the invention was made, to utilize the spray technique as taught by McClean in the etching method of Hwang et al. since by doing so it would provide the advantage of a higher etch rate.

In re claim 16, Hwang et al. do not teach that the etching rate is about 1,000 Å/min.

However, McClean teach that the etching rate can be optimized by utilizing both immersion and spray modes (col. 2, lines 10-14).

Therefore, it would have been obvious to one of the ordinary skill in the art, at the time the invention was made, to utilize both immersion and spray modes as taught by McClean in the etching method of Hwang et al. since by doing so it would provide the advantage of a desired etch rate as high as claimed.

7. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hwang et al. (US '303) in view of Spak. (US 4,220,706).

Hwang et al. do not teach that the additives include one of surfactants and metal corrosion inhibiting agents.

However, the additive has been widely used along with etching solution for the purpose of adjusting wetting properties of the etching solution, which in turn would facilitate uniform etching, as evidenced by Spak (col. 2, lines 39-47).

Therefore, it would have been obvious to one of the ordinary skill in the art, at the time the invention was made, to include the surfactant as the additive as taught by Spak in the etching solution of Hwang et al. for improving etching uniformity.

8. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hwang et al. (US '303) in view of Ward et al. (US 5,698,503).

Hwang et al. do not teach that the additives include one of sodium dihydrogen citrate, disodium hydrogen phosphate/trisodium citrate and ammonium acetate.

Ward et al., in an analogous art of wet etching, teach utilizing ammonium acetate as the additive in the etching solution (col. 3, lines 37-40) for the purpose of stabilizing the performance of the etching solution (col. 3, lines 32-33).

Therefore, it would have been obvious to one of the ordinary skill in the art, at the time the invention was made, to include the ammonium acetate as the additive as taught by Ward et al. in the etching solution of Hwang et al. for stabilizing the performance of the etching solution.

9. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hwang et al. (US '303) in view of Kim et al. (KR 2001077228 A).

Hwang et al. do not teach that the water in the etchant has a resistance greater than about 15 mΩ/cm.

However, Kim et al., in an analogous art of etching molybdenum, teach an etchant including water having resistance greater than 18 mΩ/cm (second page).

Therefore, it would have been obvious to one of the ordinary skill in the art, at the time the invention was made, to include the water having the resistance greater than 18 mΩ/cm as taught by Kim et al. in the solution of Hwang et al since by doing so it would produce a satisfactory etching solution.

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hsien-Ming Lee whose telephone number is 703-305-7341. The examiner can normally be reached on M-F (9:00 ~ 5:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on 703-306-2794. The fax phone number for the organization where this application or proceeding is assigned is 703-308-7382.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

Hsien-Ming Lee
Examiner
Art Unit 2823

Dec. 22, 2003

